ENCLOSURE #3:

# SUMMARY OF PAYLOAD INTEGRATION PLAN (PIP)

# FOR STARLAB-1 FLIGHT EXPERIMENT

## Verification of Autogenic-Feedback Training

## As A Countermeasure for Space Adaptation Syndrome

REQUIREMENTS DOCUMENT

VALIDATION OF AUTOGENIC FEEDBACK TRAINING

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## BACKGROUND

This document reflects requirements for the experiment entitled:"Autogenic Feedback Training (AFT): A Preventive Method for Space Adaptation Syndrome". AFT is a physiological training procedure that has been shown to significantly reduce the severity of motion sickness symptoms in ground-based tests. The above experiment has been accepted by NASA as a formal Life Sciences Shuttle flight study that will test the effectiveness of AFT for reducing the symptoms of SAS in Shuttle Flight crews. The final verification of AFT requires tests in space on 16 individuals, 8 who were trained and 8 Control group subjects given an alternative treatment. This experiment has been flown on STS 51-C (a pilot study of hardware and procedures, no data obtained) and on STS 51-B, where data was collected on four crewmembers (2 trained and 2 controls). Initial results of 51-B were encouraging, indicating that AFT effectively eliminated the symptoms of one crewmember who had demonstrated proficiency in control of his physiological responses preflight. The second trained crewmember experienced one symptom briefly on mission day one, while both control subjects, who took anti-motion sickness drugs, experienced multiple symptom episodes.

A Memorandum of Agreement (MOA) has been signed between NASA, Ames Research Center and USAF Space Division (February, 1986). The MOA outlines the intent to continue tests of AFT in space as a joint effort between these agencies, until the experiment goal of testing 16 individuals has been reached.

## PURPOSE/OBJECTIVES

1. To determine if preflight AFT is an effective treatment for SAS. Those subjects who receive AFT should experience fewer symptoms inflight than Control group subjects who receive no treatment or an alternative treatment.

2. To determine if preflight improvements in motion sickness tolerance can be used to predict crewmembers' success in controlling symptoms inflight. Crewmembers who demonstrate greater physiological control and are able to tolerate motion sickness stimulation significantly longer after training should experience fewer symptoms during the mission.

3. To identify differences and similarities between the physiological data from preflight motion sickness tests and data collected during symptom episodes in space.

TEST CONDITIONS/ACTIVITY REQUIRED

A. PREFLIGHT ACTIVITIES: (minimum of two crewmembers, prime and backup)

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1. BASELINE DATA COLLECTION (Treatment and Control Subjects)

L-12 months

a. Coriolis motion sickness test: The initial symptoms of motion sickness will be induced using a standard rotating chair or a rotating room called the Man Carrying Rotation Device (MCRD) at ARC. Physiological responses will be monitored and the individual's symptom characteristics will be documented.

b. Vertical acceleration motion sickness test: Initial motion sickness symptoms will be induced using the Vertical Acceleration and Roll Device (VARD) at ARC. Physiological responses will be monitored and the individual's symptom characteristics will be documented.

c. KC-135 Flights: Crewmembers will be required to wear an ambulatory monitoring garment and belt-worn instrument package containing biomedical instrumentation and a tape recorder while participating in micro-gravity maneuvers in the KC-135 aircraft at Ellis AFB. Any motion sickness symptoms occurring under flight conditions will be recorded and the individual's symptom characteristics will be documented.

d. Resting Baseline Sessions: Physiological data will be recorded while crewmembers sit quietly in a reclining chair and listen to tape recorded music for a period of 30 minutes. These resting data will be compared to physiological data obtained in the above motion sickness tests and individual "stress profiles" will be generated. Resting baseline sessions are repeated twice.

e. Joint Integrated Simulations (JIS): As Scheduled by Mission Manager. Ambulatory physiological data will be recorded on each crewmember for a period (minimum) of 12 hours--the equivalent of one mission day. Using flight hardware (or high fidelity ground support hardware), the crewmember will perform all normal mission day activities. Data collection during JIS serves two purposes: (1) The effects of normal circadian shifts on physiological levels and changes due to payload activity related movement, but NOT DUE TO SAS, can be documented and subsequently compared to flight data; and (2) Any operational difficulties identified by the crewmember regarding comfort or ease of operation of flight hardware can be documented and corrected prior to the mission.

2. AUTOGENIC FEEDBACK TRAINING SESSIONS (Treatment Subjects)

L-12 months

Treatment group subjects will be required to attend a total of 15 sessions (each 2 to 3 hours in duration). Optimally, these sessions should be administered on consecutive days. During 12 of these sessions the crewmember will receive training from the Principal Investigator and one co-investigator in control of his own autonomic responses. During 3 of these sessions, the crewmember will be given a rotating chair test to evaluate training effectiveness for the prevention and control of his motion sickness symptoms to suppress his symptoms. These sessions will be conducted at NASA/ARC.

3. FOLLOW-UP AUTOGENIC FEEDBACK TRAINING SESSIONS (Treatment Subjects)

L-4 TO L-1 months

A minimum of 4 and a maximum of 8 follow-up AFT sessions will be administered to crewmembers. These sessions will be conducted by the P.I. or designated co-Investigator, and can be performed at any location (maximum duration of 2 hours). Crewmembers will be given flight hardware (or high fidelity ground support equipment) to support this activity. The total number of follow-up sessions required will be determined by both the investigator and crewmember, and will be based on a review and discussion of his earlier training performance.

At least one additional flight on the KC-135 aircraft must be scheduled during or after follow-up AFT sessions. This KC-135 flight test will provide: (a) collection of physiological data for comparison to baseline KC-135 flights (flown at L-12 months); (b) an opportunity to apply AFT procedures to control motion sickness symptoms under ambulatory (micro-gravity) conditions. These data can be used to further evaluate training progress; and (c) practice in donning, doffing and operation of flight hardware under conditions that most closely simulate the actual mission. NOTE: For objectives (a) and (c), it is required that Control Group subjects also participate in these KC-135 flights.

4. ADDITIONAL OPERATIONAL TRAINING (All subjects)

L-4 TO L-1 months

a. Diagnostic Scale Administration: All crewmembers participating in this experiment should attend a one-hour (minimum) review session on procedures. Crewmembers will be provided with Diagnostic log books that will be identical to those used inflight. This class can be administered at any location with the assistance of an investigator.

b. One-G Trainer Class: This session will provide crewmembers with an opportunity to practice the following procedures using a written checklist: prelaunch activation of hardware, post-orbit

insertion procedures relevant to the AFT experiment, and location and identification of AFT stowage in middeck lockers. Crewmembers will use flight hardware or high fidelity ground support equipment, as well as final configuration stowage lockers. This activity should require no more than three hours and should be performed in the 1-g Shuttle mockup at NASA/JSC with the assistance of an investigator. Any changes in checklist procedures recommended by the crew can be evaluated and subsequently included in revised checklists.

c. Flight Data File Book Review: Inflight procedures, both nominal and malfunction, will be reviewed and updated (as needed). Crewmembers (both Treatment and Control Group subjects) will be given an opportunity to work directly with flight hardware (or high fidelity ground support equipment) with the assistance of an investigator. This session includes practice in donning and doffing the ambulatory monitoring garment, attaching electrodes, transducers and cable harness, and operation of data recording hardware. This activity should require no more than 2 hours and can be performed at any location. Crewmembers may opt for additional practice sessions if needed.

5. FINAL AFT VERIFICATION SESSION (All Subjects)

L-10 DAYS

A final 2 hour (Maximum) AFT verification session will be conducted by the P.I. or designated co-investigator no later than one week prior to the launch. This session can be conducted at any location, and investigators will provide crewmembers with duplicate flight hardware. This session is essential to AFT science objectives because it enables: (a) evaluation of the crewmember's ability to control his physiological responses and, if needed, further instruction and practice can be given to enhance training effectiveness; and (b) documentation of any changes in resting physiological levels (of both Treatment and Control subjects) which have occurred during the L-12 months (when these data were first recorded) and the L-10 days period. These differences in physiological response levels will be used for evaluating flight data.

6. PRELAUNCH ACTIVATION OF DATA RECORDER

a. The ambulatory monitoring garment, transducers, electrodes, AFS and recorder should be donned at the time the crewmember dresses for launch. Activation of the instrument is performed to evaluate functional status. Malfunction procedures are performed (e.g., replace electrode) if needed and power to the instrument and recorder is TURNED OFF.

b. After orbiter seat ingress, checklist procedures should be performed to initiate data recording (Start, approximately L-90 minutes).

B. INFLIGHT ACTIVITIES:

1. Timelined Activities: (All Subjects)

(a) Continuously record physiological responses for the first 3 mission days (12-waking hours). This activity will require donning of the ambulatory monitoring garment and hardware during post-sleep activity periods (10 minute duration).

(b) Replace data cassette tapes daily. (5 minute duration)

(c) Replace batteries daily. (5 minute duration)

(d) Perform diagnostic scale (written 8-item checklist) twice daily.

(Treatment Subjects only)

(e) Perform daily preventive AFT session (15 minute duration).

2. Symptom-Contingent Activities: (All Crewmembers):

(a) Press event button on personal recorder and perform diagnostic scale.

(Treatment Subjects Only)

(b) Perform counteractive AFT (30 minutes maximum duration) at any time that symptoms arise during the mission. Can be done while performing other mission payload activities.

(c) Readminister diagnostic scale AFTER counteractive AFT has been attempted.

C. POSTFLIGHT ACTIVITIES: (All Subjects)

Each crewmember will be required to participate in a 2-hour PRIVATE debriefing session with the P.I. and designated Co-investigators within 14 days postflight. Flight data tapes and diagnostic log books will have been returned to the P.I. within 24 to 36 hours postflight. These data will be discussed with the crewmember during the subsequent debriefing.

D. CREW TRAINING REQUIREMENTS:

All crew training requirements are described under Preflight Requirements.

DATA REQUIREMENTS

All hardware, including inflight diagnostic scale log books and inflight data tapes, are to be returned to the P.I. or designated representative at the landing site within 24 to 36 hours of landing.

Complete investigator/crew member privacy will be maintained at all times. No information regarding a specific crewmember's motion sickness susceptibility, preflight training or inflight performance will be released without written permission from the crewmember.

Final reports and/or journal articles will describe data obtained both preflight and inflight without identifying specific individuals, using Data Identification Codes.